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INTERETHNIC ANALYSIS OF BDNF LEVEL QUANTITATIVE INDICATOR IN YOUTHS

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Abstract

A decrease in the psychic activity performance, first voluntary memory and attention, which, together with the fall of performance of mental activity, is one of the most widespread neurological syndromes, which are traditionally named in the neurological practice as “cognitive impairments” or “cognitive decrease”. The structure of this neuropsychological syndrome is extremely variable and manifests itself in a broad spectrum of pathological conditions of the central nervous systems, both with predominantly local impairments (as a rule, in combination with disorders of gnosis, praxis and emotions) and in the case of general brain pathology.

In this paper, we try to cast light on the problem of pre-dementia conditions in young people of different ethnicity; assessment of nonspecific changes of cognitive functions; revealing the interdependence of objective indicators of audial-language memory and arbitrary attention with the level of lithium and brain-derived neurotropic factor, obtained by laboratory means.

The screening study of 50 youths was conducted, comparing Caucasian and Mongoloid races for correlation between the BDNF content in blood serum, degree of presenting signs of cognitive deficit (arbitrary audial-language memory, arbitrary attention, and psychic labor capacity) and the level of lithium in hair of the participants. The greater rate of manifestation of cognitive deficit in Caucasians and correlation between the BDNF level and lithium deficiency were established.

Keywords: Cognitive status, BDNF.

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1. Introduction

Given there are current concepts of the World Health Organization, namely, the bio psychosocial model of the human health disorder, the problem of decreasing cognitive functions is an integral part of the care and prophylaxis process. In the social context, the worsening of performance indicators of the psychic activity leads to the decrease in the patient's quality of life being one of the valuable indicators of therapeutic efficiency. If the prognosis is unfavorable, it may lead to labor, family, household, micro and macrosocial maladaptation and, as a consequence, loss of labor capacity and autonomous existence of the personality. This problem assumes special importance when a cognitive decrease takes place at an early age. This becomes a serious obstacle for following the contemporary world trend of constant increase in professional competences during entire human life, which diminishes the human capital quality at the scale of the country**.**

2. Problem Statement

Today, a series of studies, in the first order published overseas, is devoted to the problem of pre-dementia conditions in young people (Rossor, Fox, Mummery, Schott, & Warren, 2010; Sampson, Warren & Rossor, 2004). However, the question about pathogenesis of these conditions and biochemical markers accompanying the decrease of cognitive functions is still open**.**

3. Research Questions

In recent years, researchers gave increased attention to various neurotrophic factors that is caused by the very specificity of these polypeptides: the view of the nervous tissue as of something preset and subject solely to peril at later stages of development went back in time. Currently, many researches proved the ability of the nervous tissue to regeneration whose rate is preconditioned both by internal and external factors (Bogolepova, & Chukanova, 2010). In this connection, special attention is given to neurotrophic factors as compounds of the polypeptide nature having neuroprotecting action. Neurotrophins are a family of large polypeptides regulating survival, development and concerted action of neurons (Gomazkov, 2002). Numerous studies bring to a conclusion that the process of neurogenesis would be impossible without involvement of neurotrophins because there are them and some growth factors that play the leading part in regulation of neurogenesis, the process of reproduction of nervous cells in some brain areas from neural progenitors. In this sense, the role of neurotrophins and growth factors "is seen as all-embracing and can be viewed at all stages of pre- and postnatal neurogenesis, concerning the provision of the brain physiological norm and some types of neuropathology and psychopathology" (Gomazkov, 2011).

Neurotrophic and growth factors participate in cascades of biochemical reactions providing for normal functioning and regenerative capacities of nervous cells in various stress situations.

BDNF is the most well-studied, which determines involvement of cannabinoids in dopamine reactions (Zhong, Liu, Hu, Wang, Zhao & Liu, 2015) responsible for thinking plasticity and associative learning (BDNF) through the enhancer-binding protein (C/EBP) which answers for memory consolidation (Bambah-Mukku, Travaglia, Chen, Pollonini, & Alberini, 2014). Also, correlation were revealed between the BDNF level and higher mortality in the elderly with craniocerebral trauma (Failla, Conley, & Wagner, 2016), as well as between the decrease/increase of the BDNF level and development of major depressive

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disorder (Levada, 2015). Medical officers already have attempted to use BDNF as a means to treat a whole series of CNS disorders, including, in particular, neuropathy of visual nerve (Khalin, 2014; Lobzin, 2015).

Thus, the literature highlights issues related to correlation of the BDNF level and degree of manifestation of various pathological conditions. However, the question about of the BDNF level and the degree of presenting cognitive deficit remains open as it is logical to presume that with the decrease of the cognitive function, the BDNF content must change as the compensatory response of the body. This paper presents results of the conducted screening study of young people for the purpose of analysis of the correlation among the degree of manifestation of cognitive functions, the BDNF level and microelement composition of the body in the numerical aspect. Fifty youths (aged 20-25) participated in the study, out of which 36 were white Caucasians and 14 were representatives of the mongoloid ethnos. At that, we tried to establish the potential role of the BDNF level in the degree of cognitive functioning, as well as the relation between the BDNF level and the content of lithium in the body of the tested people.

4. Purpose of the Study

The objective of the work was to assess the quantitative indicator of the BDNF level in young people of Caucasian and mongoloid ethnos compared with the assessment of their cognitive functions.

5. Research Methods

Fifty participants were involved in the study based on the quota sample. All tested persons were students of the 3rd-5th year of the medical university. They were divided into two groups by race: 36 persons of Caucasian ethnicities were included in the first group, and 14 persons pertaining to mongoloid ethnicities, in the second. A pathopsychological experiment was conducted to study cognitive functions. This method of study in the Russian medical psychology (Rubinshtein, 1999; Zeigarnik, 1986) is the most adequate method of qualitative evaluation of cognitive functions. The brief version of the method was performed with the use of task tests: learning by heart 10 words as per A.P. Luriya and finding numbers in tables as per Shulte (monochrome version). The serum BDNF level was defined using the sandwich quantitative immune-enzyme array, a solid-phase immune-enzyme method (ELISA) with the application of kits for quantitative determination of human brain-derived neurotrophic factor (BDNF) in plasma.

For analysis of the microelement composition, hair from scalps was studied. Wet combustion samples were prepared in the autoclave (Teflon bomb) within the SHF complex (SEM, USA). The microelement content was determined by the method of atomic absorption at the Zhimadzu spectrophotometer (Japan) and the method of mass spectrometry at the ELAN DRC mass spectrometer (USA). In total, the content of the following microelements was examined: lithium, beryllium, boron, sodium, magnesium, aluminum, silicon, phosphorus, potassium, calcium, scandium, titanium, vanadium, chromium, magnesium, iron, cobalt, nickel, copper, zinc, gallium, germanium, arsenic, selenium, rubidium, strontium, yttrium, zirconium, niobium, molybdenum, silver, cadmium, tin, stibium, cesium, barium, mercury, and lead. Since reliable and most frequent deviations from the norm were revealed only in the lithium content (decreased in 70% participants), we felt it necessary to monitor the possible correlation between the BDNF content and lithium content.

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Statistical processing of data was performed using standard software Microsoft Excel and the statistical software package Statistika for Windows.

6. Findings

Summary assessment of the cognitive status.

A total of 50 persons were examined: 36 representatives of Caucasian ethnicities (group E) and 14 representatives of mongoloid ethnicities (group M). The following test tasks are most representative for the assessment of cognitive status: Luriya's method of learning by heart of 10 words and finding digits using Shulte tables (Rubinshtein, 1999). On the basis of study results, each group was divided into three subgroups: the first subgroup included participants which gained the maximum number of scores for both techniques; the second subgroup, participants with the clinically significant decrease of scores for one technique; and the third one, participants presenting the score decrease for both techniques. Norm of the function is, for learning 10 words: reproduction of 10 words after 4^{th} or 5^{th} repetition; after a delay, reproduction of at least 7 words; Shulte tables: time required for finding the digit is no more than 50 s per one table with an even or descending profile for five tables.

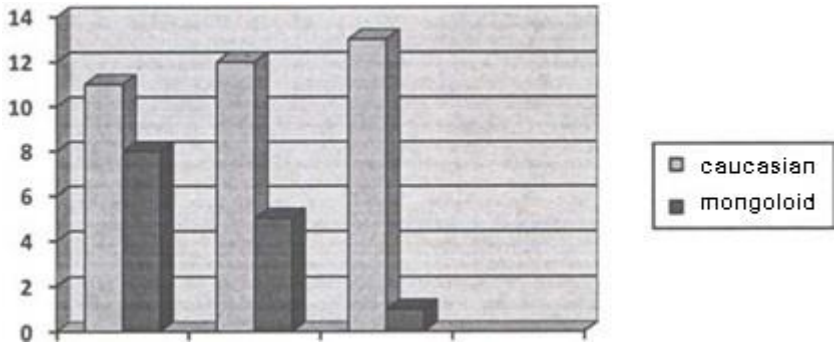

Figure 01. Subgroup distribution by assessment of the cognitive status

Thus, among representatives of Caucasian ethnicities, the distribution is like that: group 1E has 11 persons (30.5% of all studied Caucasians), group 2E - 12 persons (33%), and group 3E - 13 persons (36%). The feature distribution type in this statistical sample is asymmetrical left-sided (increased numbers of representatives with the increased level of cognitive deficiency).

The picture differs for mongoloids: group 1M contains 8 representatives of the Asian race (57% of all examined mongoloids), 2M - 5 representatives (35%), and 3M - 1 representative (7% of all surveyed mongoloids). The feature distribution type in this statistical sample is asymmetrical right-sided (decreased numbers of representatives with the increased level of cognitive deficiency).

Let us note that on the whole, among Caucasians, 69% showed moderate signs of cognitive deficiency, while among mongoloids - only 42%.

6.1. Assessment of the BDNF level.

On the basis of the immune-enzyme array of the blood serum, the BDNF content was quantified in all six subgroups of participants.

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Generally, fluctuations of the BDNF level comprise in Caucasians from 47.098 pg/ml (representative of group 3E) to 28.871 pg/ml (representative of group 2E), and in mongoloids - 49.876 pg/ml (representative of 2M group) to 28.171 pg/ml (representative of group 1M). Today, in the literature, the value of 28.39+/-3.28 pg/ml is considered to be the norm for BDNF content in blood serum.

Table 01. Average indicators of the BDNF content in the examined subgroups.

	1 group	**2 group**	**3 group**
Caucasians	34669 pg/m	36058 pg/ml	35403 pg/ml
Mongoloids	32885 pg/ml	39723 pg/ml	41456 pg/ml
Norm	28390+/-3280 pg/ml		

Therefore, the greatest increase of the BDNF level is observed in the second and third subgroups, i.e. with the decreasing cognitive status, the content of this neurotrophic factor in blood serum rises by up to 30% of the normal blood serum level.

6.2. Assessment of the correlation between the BDNF level and lithium content in hair of participants.

The interest in lithium as a specific microelement is caused by the role of lithium in the functioning of the central nervous system. Lithium facilitates the decrease of excitability of the nervous system, diminishes the quantity of available free noradrenalin and content of serotonin in the CNS and boosts the sensitivity of neurons in some brain areas to the action of dopamine.

In accord with the revealed subgroups, we carried out the analysis of Pearson's correlation between the BDNF level and content of lithium in the hair. The analysis showed the reliable connection in second subgroups both for Caucasians ($r=0.72$, $p<0.05$) and mongoloids ($r=0.90$, $p<0.05$). In other subgroups, no reliable relation of the lithium and BDNF levels was observed.

7. Conclusion

The screening study of young people comparing Caucasian and Asian races established that 69% of tested Caucasians and 42% of tested mongoloids showed some signs of cognitive deficit. The reliable correlation between the level of BDNF and lithium content was revealed in subgroups with a moderate decrease of cognitive functions. In future, the extension of the study sample is required to verify the results obtained and boost the prognostic value of the study.

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